THE HYDROLYSIS OF DIHYDROURIDINE AND RELATED COMPOUNDS

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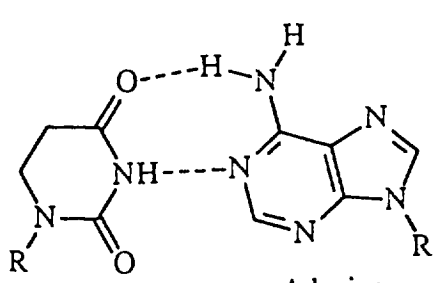
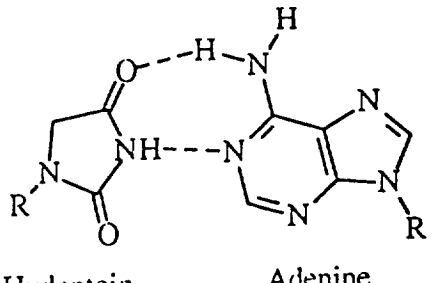
Dihydrouridine is absent from the tRNA of almost all hyperthermophiles and most Archaea, but is ubiquitous in the tRNA of Eubacteria and Eukaryotes. In order to investigate whether this could be due to instability, the rate of ring opening of dihydrouridine was measured from 25°C to 120°C at pH values ranging from 6 to 9. The dihydrouridine ring is stable at 25°C, but the half-life at 100°C and pH 7 is 9.1 hours, which is comparable to the doubling time of hyperthermophiles. This suggests an explanation for the absence of dihydrouridine from the tRNA of hyperthermophiles (House and Miller, 1996). The absence of dihydrouridine from low temperature Archaea may be due to their having descended from hyperthermophiles.

The rates of ring opening of dihydrouriacil, dihydrothymine, and 1-N-methyldihydrouracil were measured at 100°C and pH 6-9, as were the equilibrium constants for ring closure of the ureido acids to the dihydrouracils. The pH rate profiles for ring opening and ring closing were calculated from the data.

Because β-amino acids, urea, and cyanate are potentially prebiotic molecules, dihydrouracils may have been important in a pre-RNA world. Dihydrouracil hydrogen bonds to adenine are much weaker than those of uracil with adenine, so that a polyDHU-polyA double helix is not stable at room temperature. However, DHU-A double helices may be more stable with an alternative backbone to ribose-phosphate that lacks negatively charged phosphate.



Dihydrouracil Adenine



Hydantoin Adenine

Other roles that dihydrouracils may have played in early life include breaking the Watson-Crick hydrogen bonding and forming special structures in early ribozymes. Finally, dihydrouracils may be important for separating the double strand of an early genetic molecule. At high pH, dihydrouracil rings would open forming a negative charge and helping to separate the two strands. Lowering the pH would reform the dihydrouracils and stabilize the double helix.

Hydantoins are also prebiotic compounds, and their concentration in the prebiotic ocean may have been greater than that of dihydrouracils because α-amino acids were more abundant than β-amino acids. The hydrogen bonding of hydantoins to adenine may be stronger than with dihydrouracil.

House, C. H. and Miller, S. L. : 1996, *Biochemistry* 35, 315-320.

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In the prebiotic synthe adenosine and adenosine ultra-violet irradiation phosphoric acid or poly reported the damage bases,nucleosides and nu [3]. We found that the and nucleotides photoionization of orthc pressure mercury arcs (M Cytosine in phosphate sensitization mechanisr photochemical reaction chromatography on a 3 purified by recrystall photoproduct by elemen characteristic absorption extinction coefficient 1.2: The infrared spectra and spectrum appeared to phosphate anion radical s hydrophosphate. Oxygen